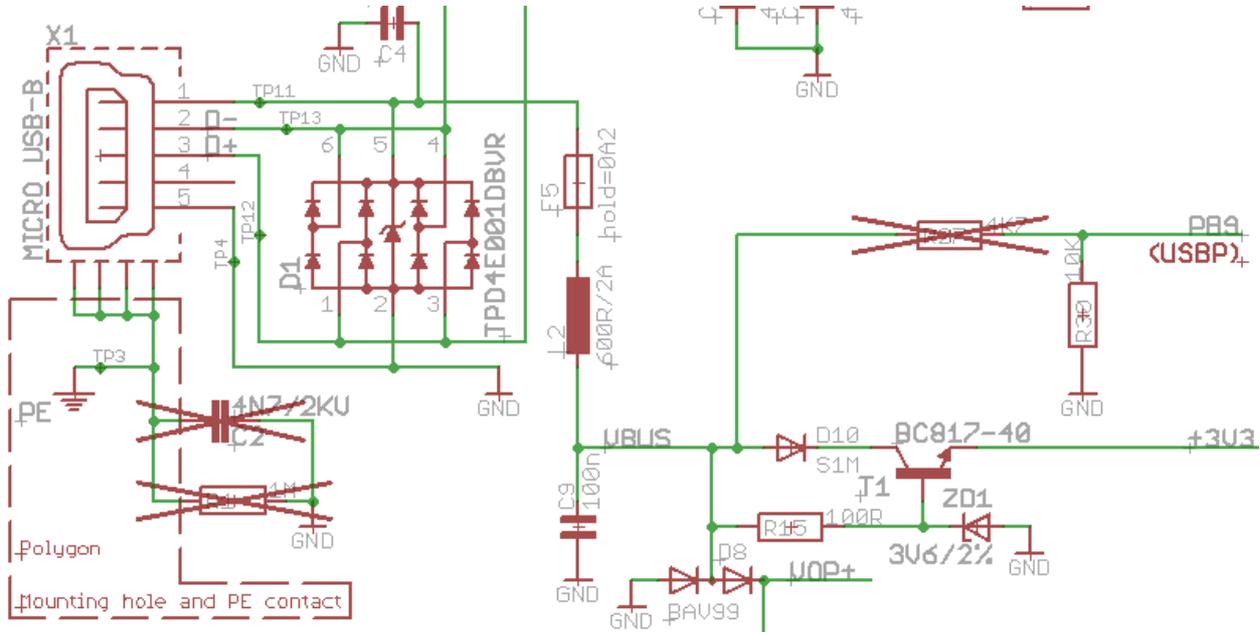


8.4 USB-supply

To enable basic functionality power can be obtained via USB. Voltage supplied by USB is in the range of $V_{bus} = 4V35...5V25$, see „Universal Serial Bus Specification 2.0“, chapter 7.2.1.3 , 7.2.1.4, 7.2.2.

When power for MCU and peripherals is provided by the low cost voltage stabilizer, described on the following lines, the output current must be limited due the 250mW max. power dissipation of the BC817 (T1). To enable higher output current, diode D10 is added to the current path, to lower the input voltage of T1 and to dissipate a part of the thermal dissipation loss via the diode.



Accuracy of the 3V3 output is limited to the tolerance of zener diode ZD1 and the simple regulators overall performance.

Table based on diode ZD1 having 3V50 @ 5mA, temperature = 23°C, Values in brackets taken with D10 shorted.

ZD1		3V6							
R15		147R			100R				
VBUS [V]	Current [mA]	Vout[V]	Vzd1[V]	Vzd1[V]	Vout[V] ^{1.)}	Vout[V] ^{2.)}	Vout[V] ^{3.)}	Vout[V] ^{4.)}	Vout[V] ^{5.)}
4,35	0	(3,17) 3,16	(3,62) 3,61	3,72	3,23				
4,35	14	(2,97) 2,95	(3,62) 3,61	3,72	3,06				
4,35	100	(2,90) 2,84	(3,61) 3,55	3,70	2,98	2,83	2,96	2,93	2,94
4,35	200	(2,87) 2,77	(3,59) 3,52	3,67	2,91	2,61	2,88	2,81	2,83
4,35	300	(2,82) 2,66	(3,53) 3,44	3,62	2,84				
4,35	400	(2,73) 2,53	(3,43) 3,32	3,53	2,72				
4,35	500	(2,51) 2,24	(3,21) 3,03	3,42	2,61				
5,25	0	(3,37) 3,38	(3,85) 3,85	3,93	3,47				
5,25	15	(3,18) 3,18	(3,85) 3,85	3,94	3,29				
5,25	100	(3,22) 3,19	(3,84) 3,84	3,94	3,28	3,18	3,25	3,23	3,22
5,25	200	(3,17) 3,13	(3,84) 3,83	3,93	3,25	3,06	3,22	3,18	3,17
5,25	300	(3,16) 3,07	(3,81) 3,80	3,91	3,20				

5,25	400	(3,08) 3,00	(3,74) 3,73	3,85	3,15				
5,25	500	(2,93) 2,85	(3,58) 3,57	3,77	3,02				
6,00	100	(3,32) 3,31	(3,96) 3,96	4,08	3,42				

Output voltage:

- 1.) Fuse F5 = 0R resistor
- 2.) Fuse F5 = ERF SN020-30, $I_{hold}=0A2$, $I_{trip}=0A4$
- 3.) Fuse F5 = MC36195, $I_{hold}=0A75$, $I_{trip}=1A5$
- 4.) Fuse F5 = 1R resistor
- 5.) Fuse F5 = ERF SN050-08, $I_{hold}=0A5$, $I_{trip}=1A0$, measured on board rev. 0002B3

Table showing output voltage dependency from ZD1 temperature.

ZD1			3V6			
R15			147R		100R	
VBUS [V]	Current [mA]	Temperature ZD1 [°C]	Vout[V]	Vzd1[V]	Vout[V]	Vzd1[V]
5,25	0	-30	3,45	3,91	3,54	4,06
5,25	100	-30	3,21	3,90	3,36	4,04
5,25	200	-30	3,18	3,90	3,33	4,04
5,25	0	100	3,31	3,77	3,43	3,91
5,25	100	100	3,07	3,76	3,22	3,90
5,25	200	100	3,05	3,75	3,21	3,90

Conclusion: without D10 (D10 shorted) output current must be limited to $0,25 / (5,25 - 3,2) == 120mA$, with D10 included output currents up to $0,25 / (5,25 - 3,2 - 0,8) == 200mA$ are allowed.

Output voltage variation is within 2V8...3V6 limits when:

- zener diode with 2% tolerance is used
- R15 == 100R
- current is 15mA...200mA
- temperature is -30°C...100°C
- input voltage is 4V35... 5V25
- Fuse F5 is a 0R resistor or of type MC36195 or equivalent (ERF SN050-08)

RS485 interface IC (ISL3243xxx) and LM224 may come out of specification (min. $V_{cc} == 3V0$), but these functionalities are not mandatory when power is supplied via USB.

Using a fuse of type SN020-30 for F5 is not possible, use ERF SN050-08 or 0R resistor.